# U.S. Passive House Projects – Net Plus Energy Homes

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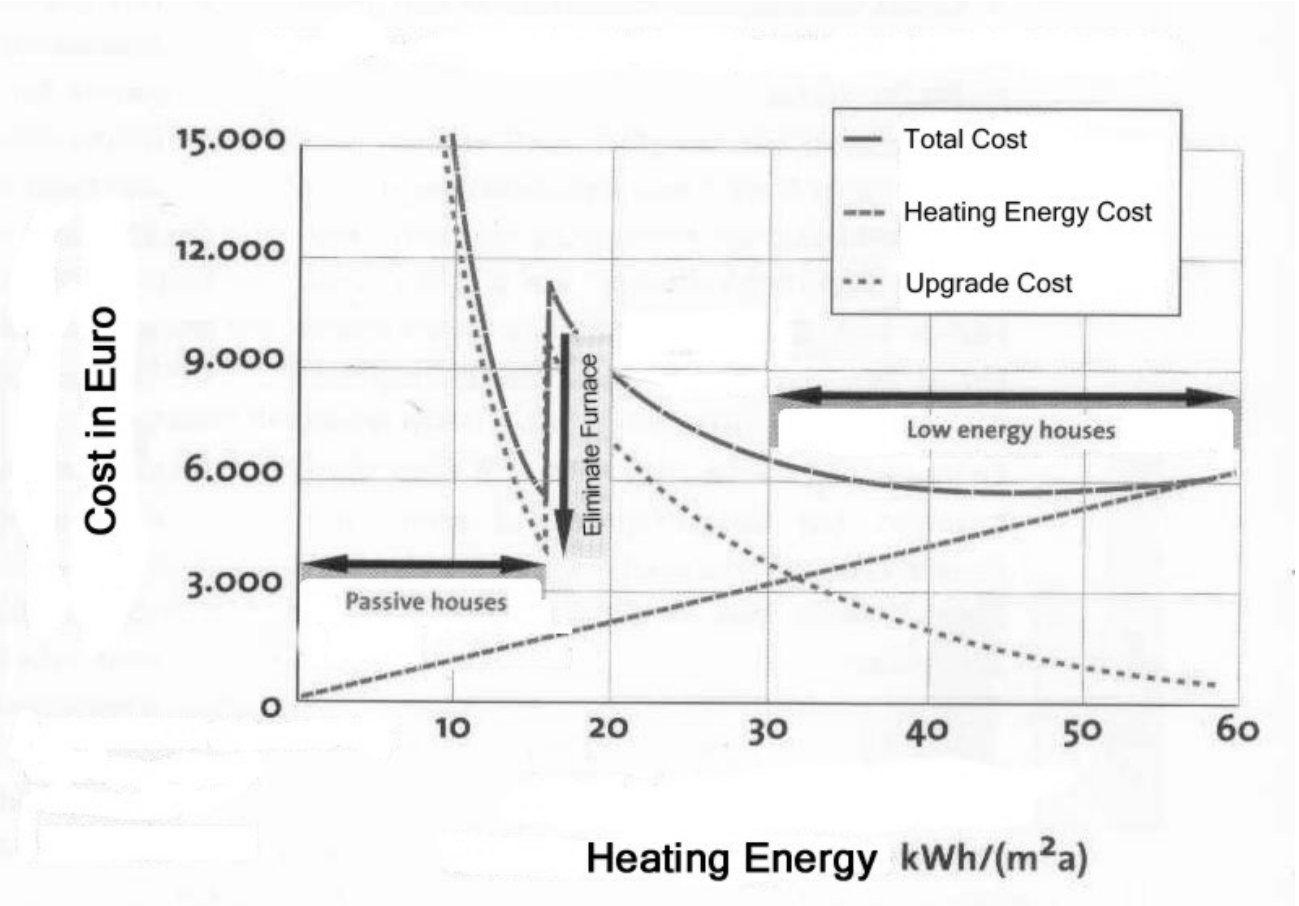
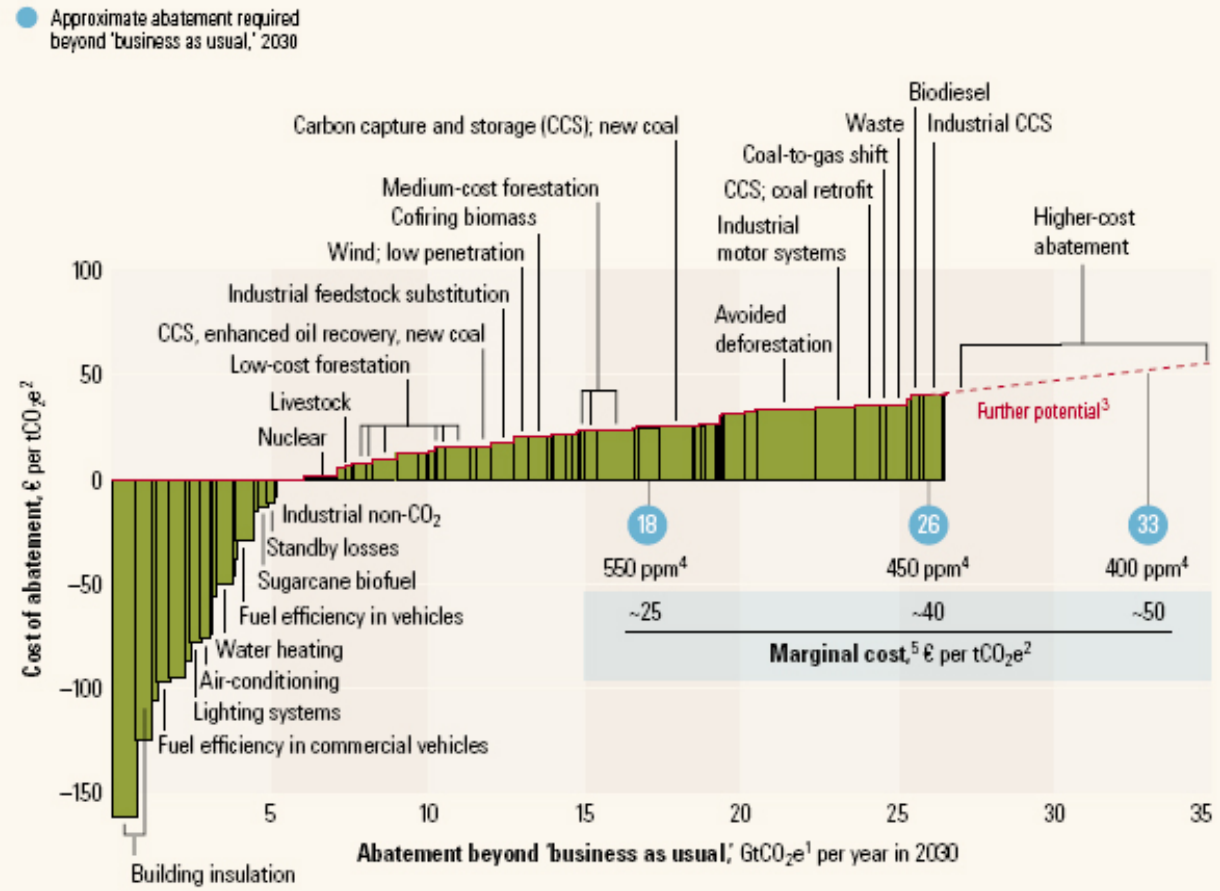
# Passive House -
# "WHOLE > SUM:PARTS"

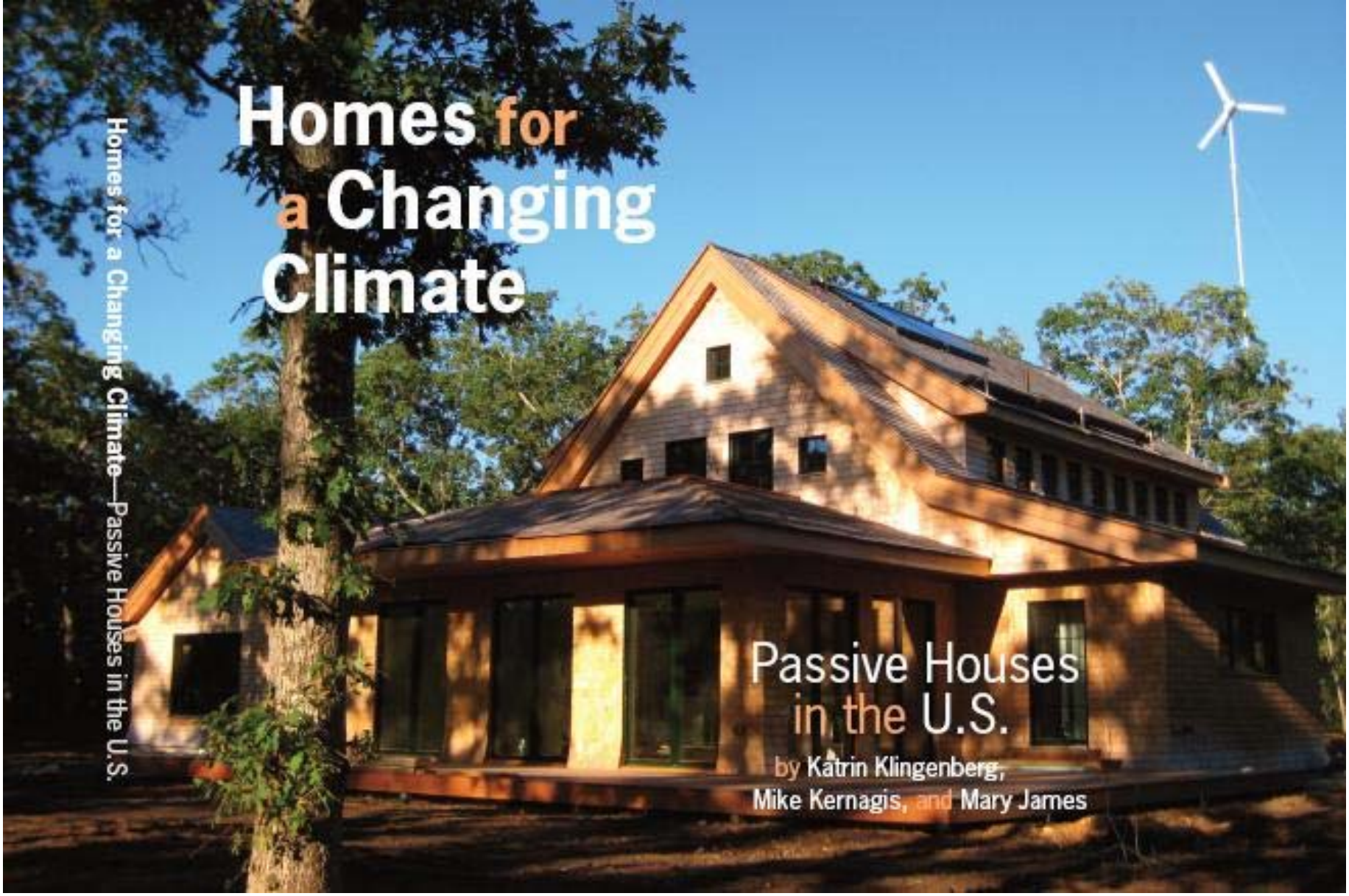


Global cost curve for greenhouse gas abatement measures beyond 'business as usual'; greenhouse gases measured in $GtCO_2e$[1]




[1] $GtCO_2e$ = gigaton of carbon dioxide equivalent; "business as usual" based on emissions growth driven mainly by increasing demand for energy and transport around the world and by tropical deforestation.
[2] $tCO_2e$ = ton of carbon dioxide equivalent.
[3] Measures costing more than €40 a ton were not the focus of this study.
[4] Atmospheric concentration of all greenhouse gases recalculated into $CO_2$ equivalents; ppm = parts per million.
[5] Marginal cost of avoiding emissions of 1 ton of $CO_2$ equivalents in each abatement demand scenario.

Image Source: McKinsey Quarterly Report


Homes for a Changing Climate
Homes for a Changing Climate—Passive Houses in the U.S.
Passive Houses in the U.S.
by Katrin Klingenberg, Mike Kernagis, and Mary James

# Project Data of the Cleveland Farm:

| | |
|---|---|
| **Location** | West Tisbury, Massachusetts |
| **Region and climate** | *Latitude:* 41°22'48"<br>*Longitude:* 70°40'12" *Elevation:* 89 ft<br>Cold climate |
| **Heating degree-days/ cooling degree-days** | 5,713/436 |
| **Year of construction** | 2007–2008 |
| **Typology** | Single-family residence |
| **Finished floor area** | 422 m2 (4,544 ft2) |
| **Architect** | Craig Buttner, Architect P.C. |
| **Builder** | Clancy Construction |
| **Project Cost** | $1.2 Million ($264 per finished sq ft) |

# The Cleveland Farm House by the Numbers

## based on the PHPP 2004 calculations:

*specific heating energy requirement:* ***14.9 kWh/m2a (4.7 kBtu/ft2/yr)***

*specific primary energy requirement:* ***43 kWh/m2a (13.6 kBtu/ft2/yr)***

*peak heating load:* ***12.6 W/m2 (3.99 Btu/h/ft2)***

*airtightness:* ***0.6 ACH50***

*surface area-to-volume ratio (A/V):* ***1.05***

**Active System requirement to become *plus energy/carbon neutral***

5 kW wind turbine

# Smith House – 2003, IL

# Project Data for the Smith House:

| | |
|---|---|
| **Location** | Urbana, Illinois |
| **Region and climate** | *Latitude:* 40.116N<br>*Longitude:* 88.243W *Elevation:* 738 ft<br>Cold climate |
| **Heating degree-days/ cooling degree-days** | 6,359/888 |
| **Year of construction** | 2002-03 |
| **Typology** | Single-family residence |
| **Finished floor area** | 111 m2 (1,200 square feet, including double story space) |
| **Owner/Designer** | Katrin Klingenberg/Nicolas Smith |
| **Builder** | Edward Sindelar Chicago |
| **Project Cost** | $135,000 ($112 per finished sq ft) |

# The Smith House by the Numbers

## based on the PHPP 2004 calculations:

*specific heating energy requirement:* ***8 kWh/m2a (2.5 kBtu/ft2/yr)***

*whole-house specific primary energy requirement:* ***111 kWh/m2a (35.2 kBtu/ft2/yr)***

*peak heating load:* ***13.1 W/m2 (4.2 Btu/h/ft2)***

*airtightness:* ***0.6 ACH50***

*surface area-to-volume ratio (A/V):* ***0.74***

**Active System requirement to become *net zero site energy***

2 kW photovoltaic system (not installed but wired in)

**Active System requirement to become *plus energy/carbon neutral***

5 kW photovoltaic system (not installed but wired in)

# The BioHaus – 2006, MN

# Project Data of the BioHaus:

| | |
|---|---|
| **Location** | Bemidji, Minnesota |
| **Region and climate** | *Latitude:* 47º28'14" N *Longitude:* 94º52'39" W<br>*Elevation:* 1,350 ft<br>Very cold climate |
| **Heating degree-days/ cooling degree-days** | 9,869/296 |
| **Year of construction** | 2006 |
| **Typology** | School building |
| **Finished floor area** | 401.3 m2 (4,320 ft2) |
| **Owner** | Concordia Language Village |
| **Architect** | Stephan Tanner, AIA |

# The Smith House by the Numbers

## based on the PHPP 2004 calculations:

*specific heating energy requirement:* ***13.7 kWh/m2a (4.35 kBtu/ft2/yr)***

*specific primary energy requirement:* ***83 kWh/m2a (26.3 kBtu/ft2/yr)***

*airtightness:* ***0.18 ACH50***

*surface area-to-volume ratio (A/V):* ***0.68***

**Active System requirement to become *net zero site energy***

3.5 kW PV system (not installed but wired in)

**Active System requirement to become *plus energy/carbon neutral***

10.8 kW PV system, planned system : 25 kW PV System

# Stanton Residence: Scheduled to be finished in Feb ’09, Urbana Illinois

Passive House Institute US

**NZE-Workshop, Colorado Springs**
**Feb 2-3, 2009**

# Fairview 1+2 - 2005-07

# Passive Houses are feasible for Retrofits!

## Tahan Residence, Berkeley CA

# Solar Decathlon Winning Entry 2007

## University of Darmstadt

# Kerr Avenue, Urbana IL: Carbon-Neutral Passive Townhouses planned for 2009-10

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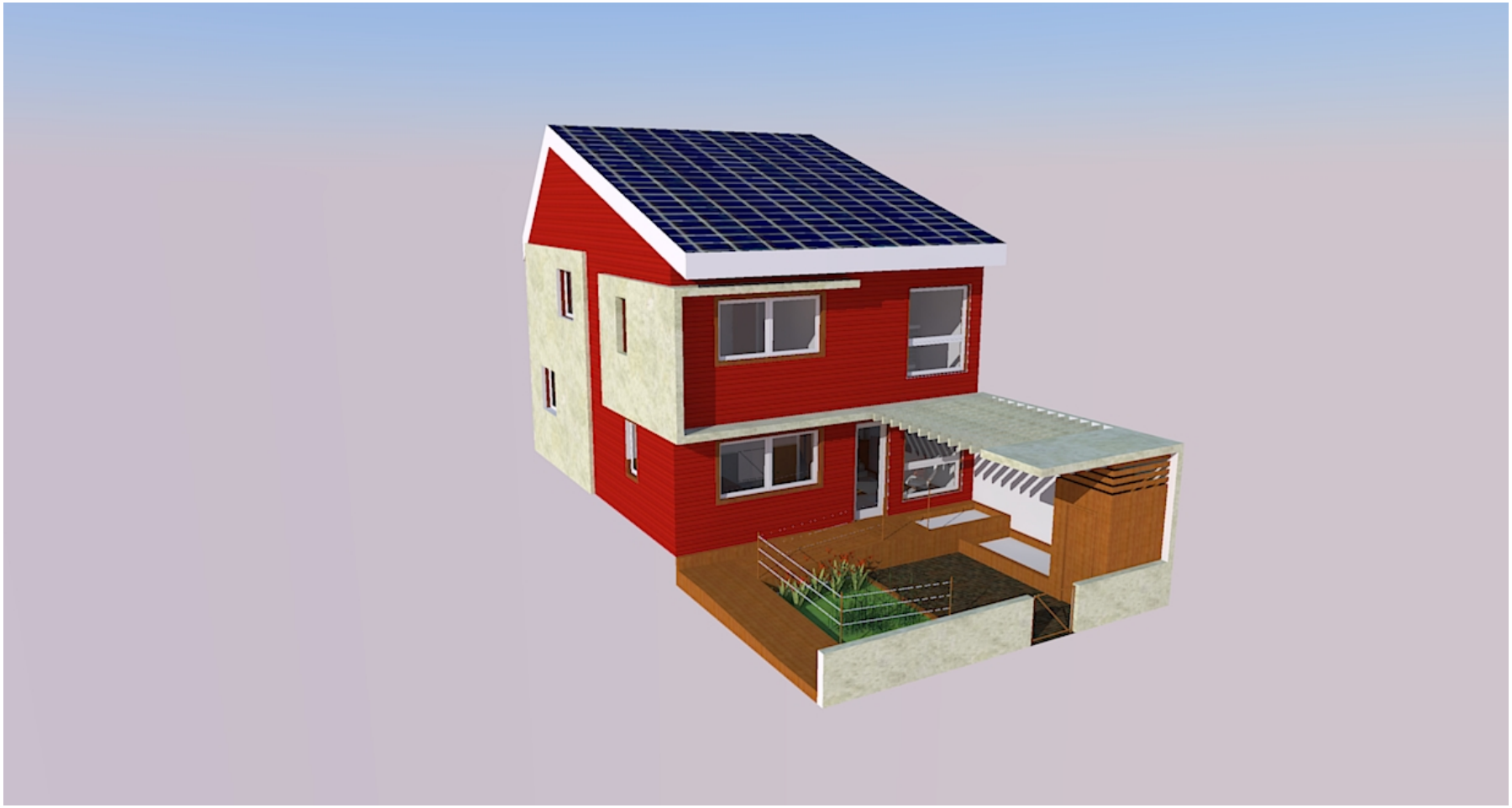
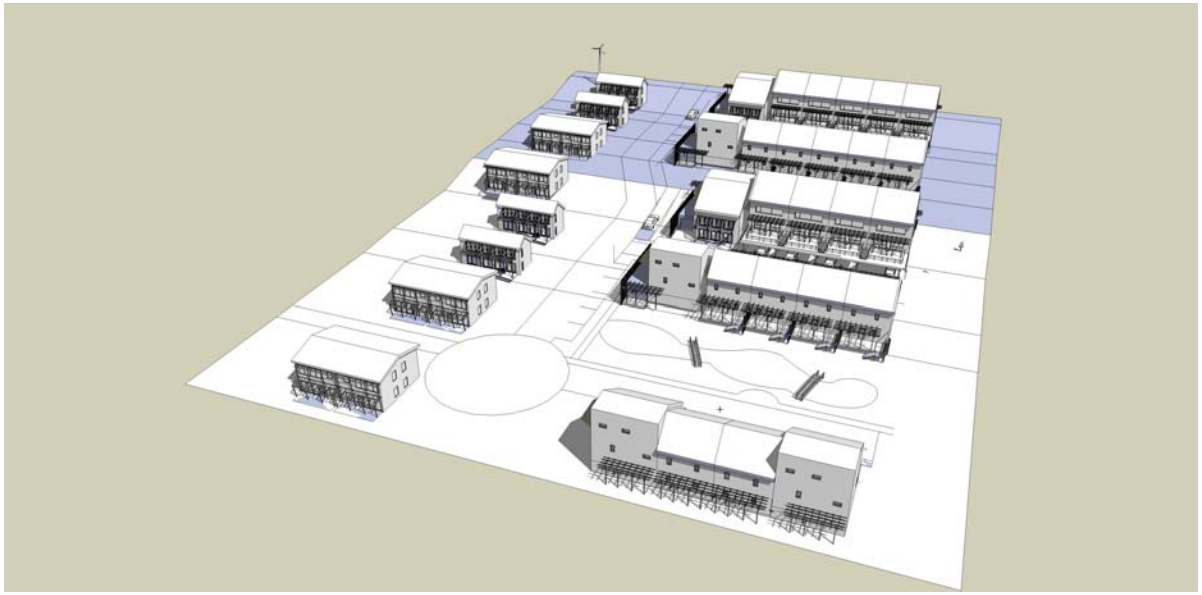
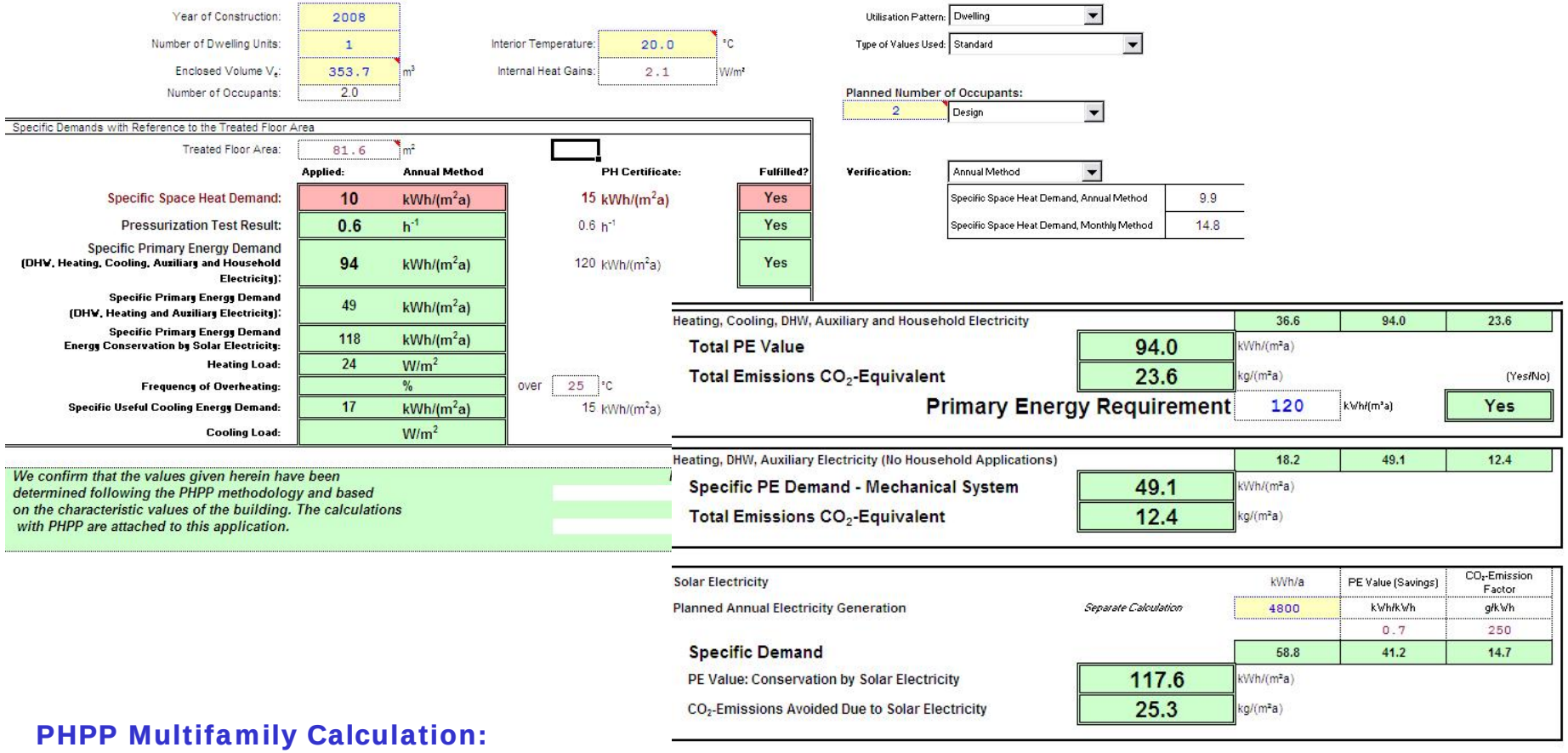
# Kerr Avenue, Urbana IL: Passive Townhouses, Pl



# Kerr Avenue, Urbana IL: Carbon-Neutral Passive Townhouses planned for 2009-10

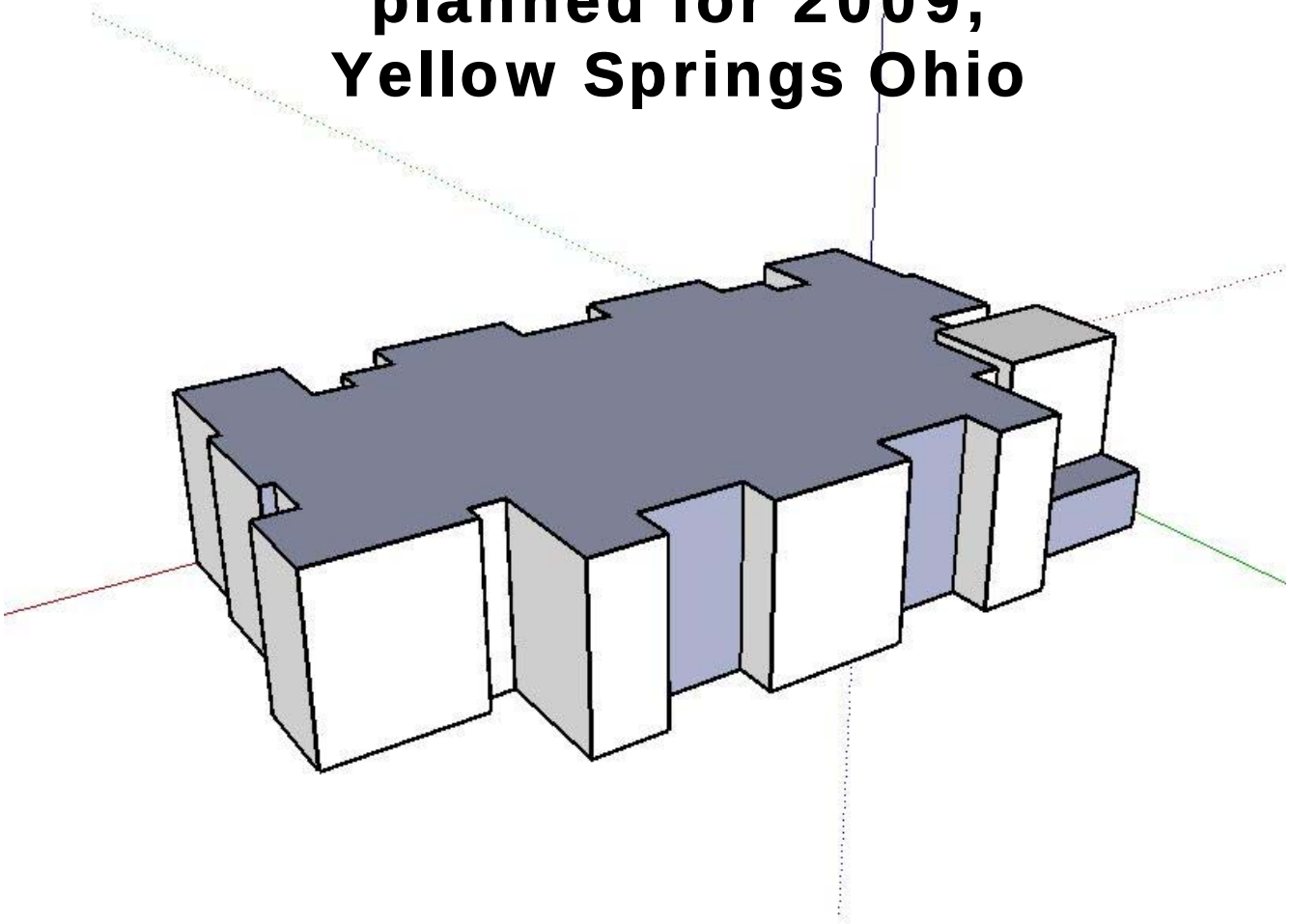





## PHPP Multifamily Calculation:

1. **Overall Volume can be used to certify building / meet PH standard**
2. **End house or worst case scenario apartment has to be modeled separately to calculate peak heat / cooling load**
3. **Each Passive Townhouse only needs about 3.5 kW PV array to become net plus energy and carbon-neutral! Cost for PH components: $16,000 PV after Rebate: $20,000**
4. **10 % additional cost for PH compared to standard construction, an additional 12.5 % for PV**

# Friends Care Facility: 38 Apartments, planned for 2009, Yellow Springs Ohio



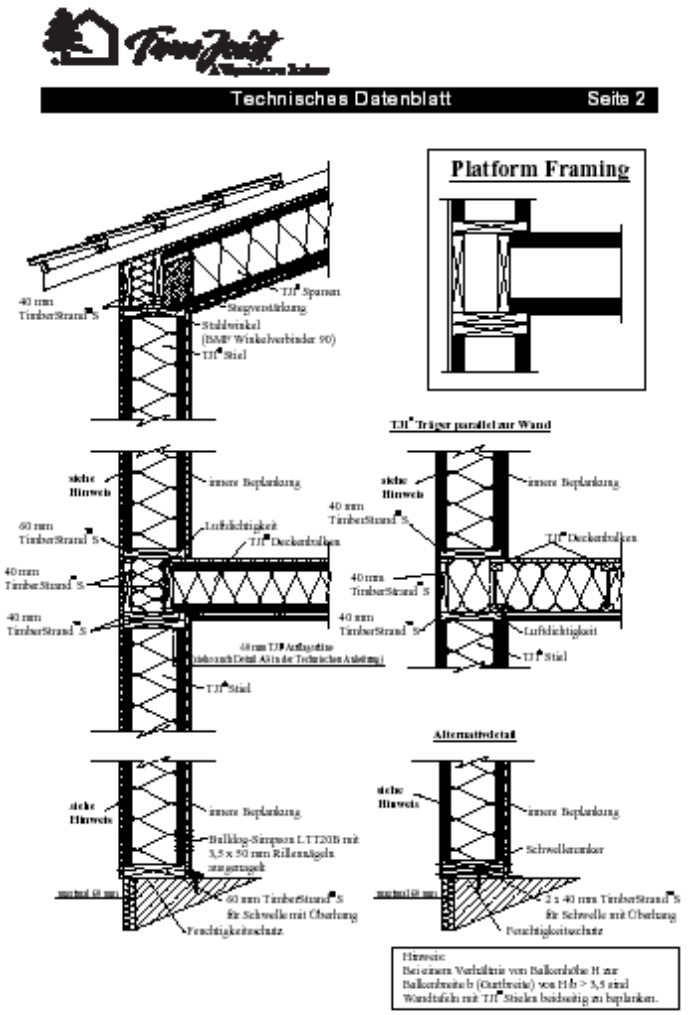
# Approx. 250 Unit mixed development, planned for 2009,Boulder, CO

# Passive House PHCs / Activities in the U.S.:

# What is needed?

- **Professional Training:**
  - **-Passive House Consultants & Contractors**
  - **-Training, Trade Schools**

- **Passive House Components**
  - **-Insulation**
  - **-Window**
  - **-Wall System etc.**

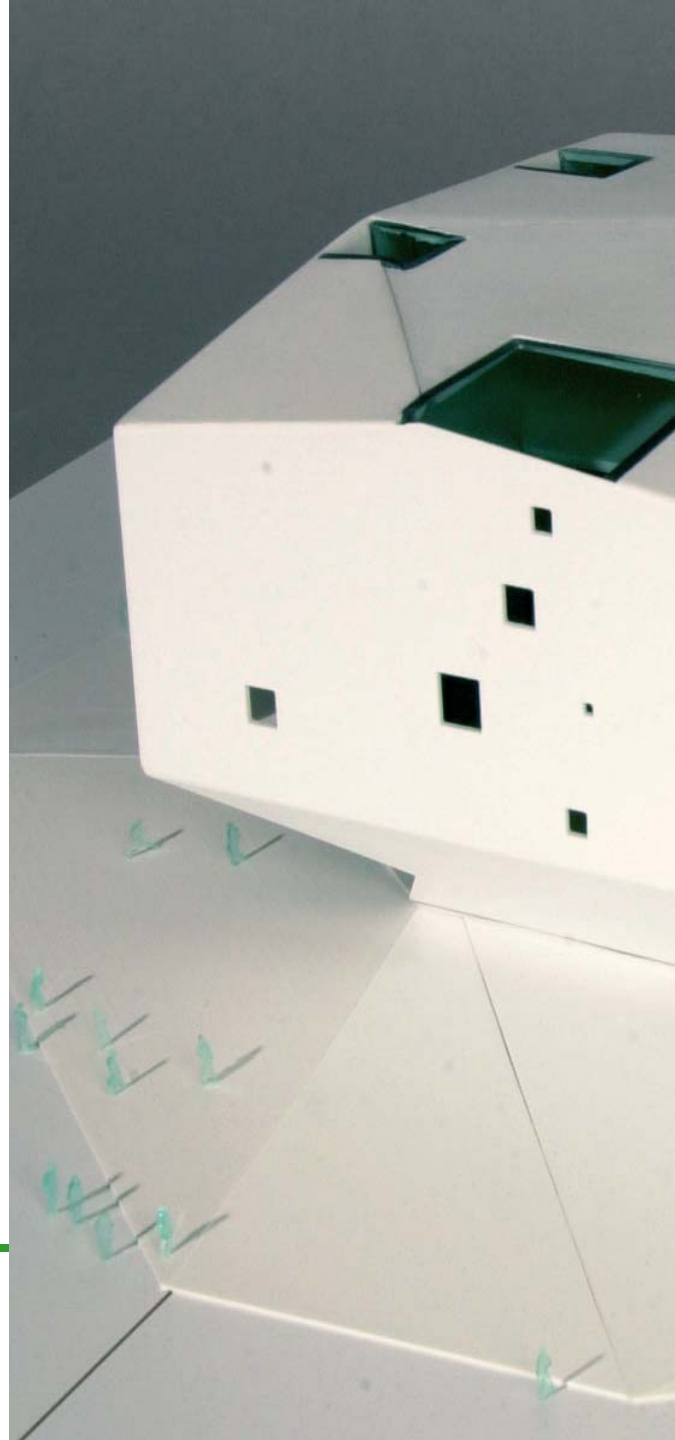


# M.A. PH+: Passive House Master of Arts -Architecture

**Passive House Masters Program, first of its kind in Germany started Sep 2008:**

**Fachhochschule Erfurt, Germany**

**Partnerships with US schools in the States Are being pursued in NYC and Chicago.**



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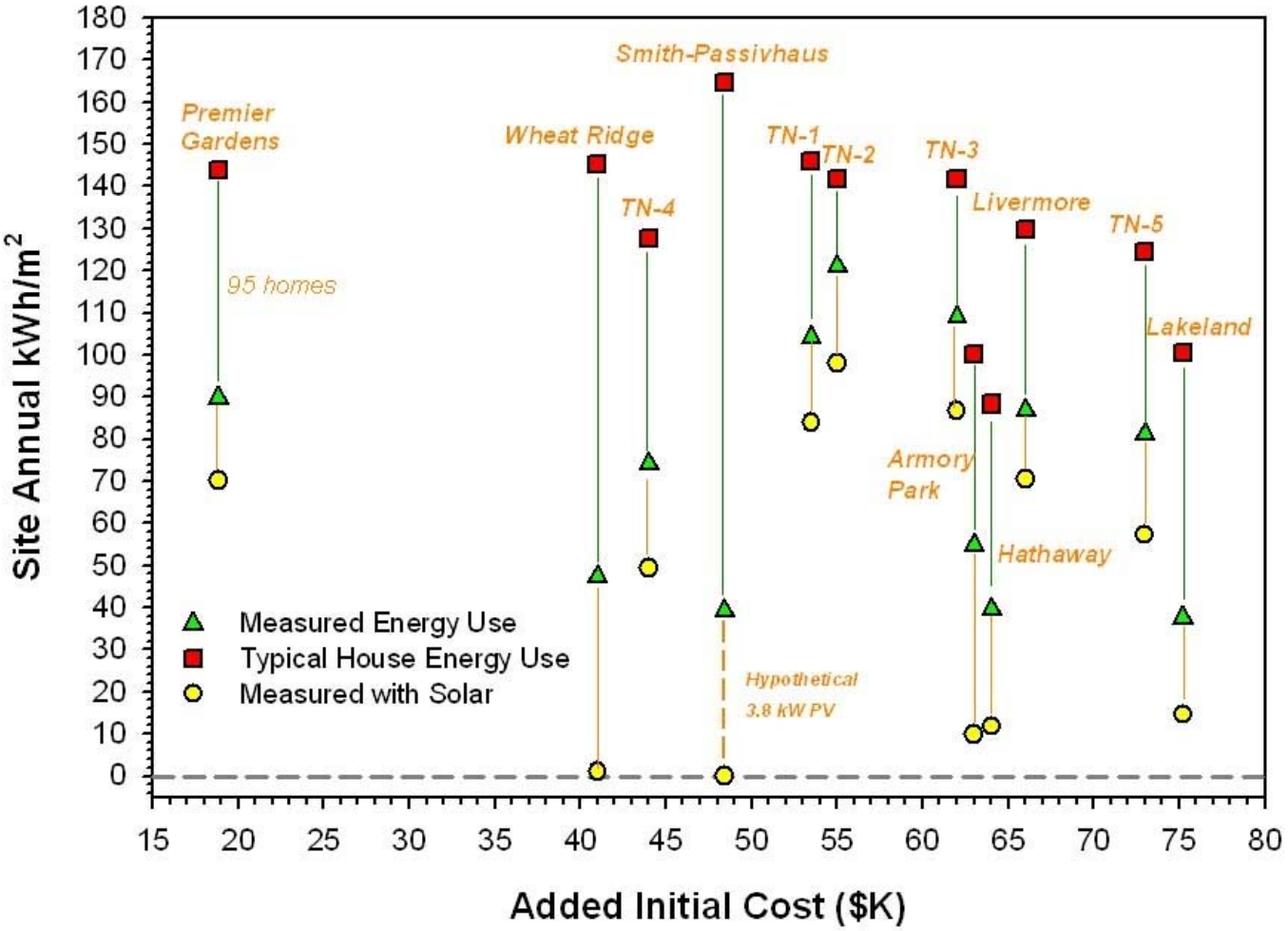
# Solar Decathlon Winning Entry 2007

## University of Darmstadt

# Cost vs. Measured Total Energy Use of a Compendium of Very Low Energy Homes




Study done by the Florida Solar Energy Center in conjunction with the Lawrence Berkeley National Laboratory, Author: Danny Parker